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A PRIMER ON NUCLEAR WEAPONS CAPABILITIES,(U)
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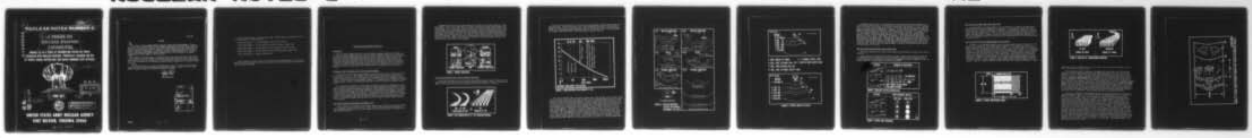

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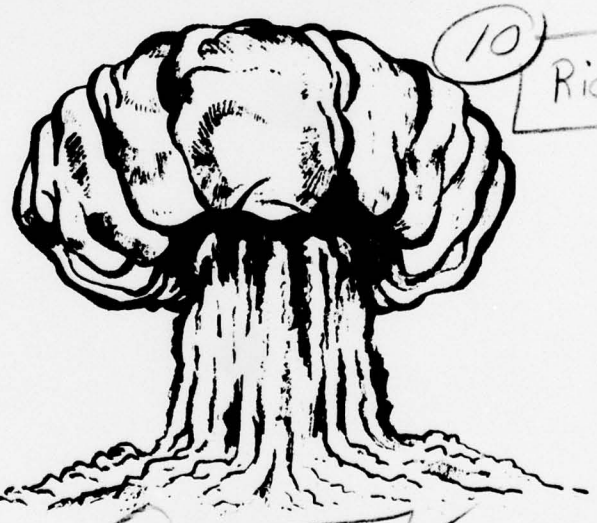
NUCLEAR NOTES NUMBER 6

A PRIMER ON NUCLEAR WEAPONS CAPABILITIES

NUMBER SIX IN A SERIES OF INFORMATION PAPERS ON TOPICS ASSOCIATED WITH NUCLEAR WEAPONS, PRINCIPALLY DESIGNED FOR USE BY TRADOC SCHOOL INSTRUCTORS AND MAJOR COMMAND STAFF OFFICERS.

Richard L. Beller



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UNITED STATES ARMY NUCLEAR AGENCY
FORT BELVOIR, VIRGINIA 22060

June 1977

FOREWORD

The series of papers, ~~"Nuclear Notes," prepared by the US Army Nuclear Agency~~ is intended to clarify and explain various aspects of nuclear weapons phenomenology and usage. These papers are prepared in as nontechnical a fashion as the subject matter permits. They are oriented toward an audience assumed to be responsible for teaching or in some way evaluating the tactics and techniques of employing nuclear weapons in a conflict situation. Their dissemination will hopefully provide to the US Army ~~accurate, up-to-date~~ information of critical importance to a reasoned understanding of nuclear weapons on the battlefield.

The intent of this nuclear note is to provide a simple text to provide a basic understanding of the importance of nuclear weapons on the battlefield for the soldier and officer, who has not received formal training in the capabilities of nuclear weapons available to the tactical commander. This nuclear note should put into perspective nuclear effects as they pertain to the modern battlefield.

The principal author of this paper is Major Richard L. Beller of the US Army Nuclear Agency. Comments and views of readers are desired and should be forwarded to Commander, US Army Nuclear Agency, 7500 Backlick Road, Building 2073, Springfield, VA 22150.

WALTER G. PARKS
COL, AD
Deputy Commander

The US Army Nuclear Agency recommends that issues of Nuclear Notes be retained and filed in a loose leaf binder. Previous issues are:

Nuclear Notes Number 1 - The Electromagnetic Pulse (EMP), June 1974

Nuclear Notes Number 2 - The Army Nuclear Survivability Program, October 1974

Nuclear Notes Number 3 - The New Nuclear Radiation Casualty Criteria, May 1975

Nuclear Notes Number 4 - Nuclear Blackout of Tactical Communications, August 1976

Nuclear Notes Number 5 - Rainout, December 1976

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A PRIMER ON NUCLEAR WEAPONS CAPABILITIES

INTRODUCTION

Tactical nuclear weapons have been in the US commander's arsenal since the early 1950's. In the 1960's the Soviets deployed the free rocket over ground (FROG) and SCUD missile, both capable of delivering nuclear weapons against land forces. With the essential parity of US and USSR strategic forces, battlefield nuclear weapons have increased in importance. Recent changes in the employment concepts of these weapons have created a need to provide the commander and his men a "feel" for what nuclear weapons will do for or to them on the battlefield. With this knowledge, a commander can appreciate the vast number of options that can be made available to increase the intensity of tactical nuclear warfare and possibly avoid all-out strategic nuclear warfare by terminating the conflict at the lowest level of hostilities on terms acceptable to the US and her Allies.

WHY SHOULD I KNOW THE CAPABILITIES OF TACTICAL NUCLEAR WEAPONS?

The decision to use tactical nuclear weapons on the battlefield will be a political one based on the enemy's first use of their weapons of mass destruction or the inability of conventional forces to halt the attack. The ultimate objective of the employment of nuclear weapons is to decisively terminate the conflict at the lowest level of hostilities possible. Although the level of concern is usually above the unit commander's interest, it is necessary that he be aware of the goals at higher levels in order to understand the application of force to decisively terminate the conflict.

For the tactical employment of nuclear weapons to achieve its objective, commanders and their men at all levels must be familiar with the effects of nuclear weapons on the battlefield. Historically, the Army's technical procedures for employing nuclear weapons and high security classification of weapon characteristics have caused commanders to relegate the nuclear aspects of the battlefield to the "prefix 5 types" while retaining the conventional planning for themselves and their principal staffs. This should not be the case. A commander must understand the basics of planning to make the best use of all the resources with which he has to fight. The purpose of this nuclear note is to help commanders and their men understand the nature of the nuclear battlefield by presenting in unclassified, layman terms the capabilities of the tactical nuclear weapons available in our arsenal.

WHAT NUCLEAR WEAPONS EFFECTS SHOULD BE IMPORTANT TO ME?

Before considering the capabilities of nuclear weapons, let us briefly discuss nuclear effects. It is important that you understand nuclear effects as they relate to personnel casualties and materiel damage in order for you to use your weapons effectively and to protect your command from enemy nuclear detonations.

The effects produced from any nuclear weapon may be divided into two major categories, initial and residual. Figure 1 illustrates the partitioning of energy from a typical fission weapon. Residual effects, i.e., fallout and rainout, are primarily of long term importance but, under certain circumstances, may also have serious impact on the success or failure in the immediate battle area. Initial effects occur in the immediate area within one minute after the detonation and are of most importance to the commander since they will create personnel casualties and materiel damage within the timespan of the current operation. The principal initial effects are blast, thermal radiation, and nuclear radiation. Other initial effects (Electromagnetic Pulse (EMP) and Transient Radiation Effects on Electronics (TREE)) are important with respect to electronic equipment, especially the consideration of protecting one's own equipment.

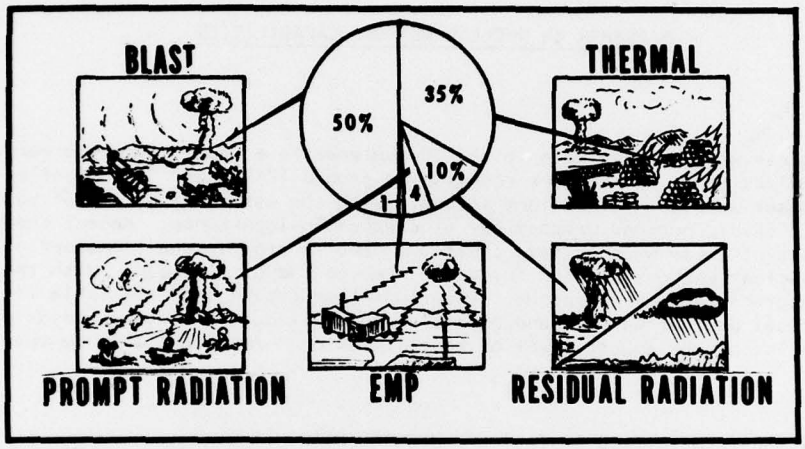


FIGURE 1. ENERGY PARTITION.

WHAT WILL THESE EFFECTS DO ON A TACTICAL NUCLEAR BATTLEFIELD?

The nuclear yields most likely to be used in the main battle area and near the forward line of troops will be on the order of 1 KT to 10 KT (TNT equivalent in kilotons). Figure 2 illustrates the amount of TNT required to produce the equivalent air blast resulting from a 1 KT burst.

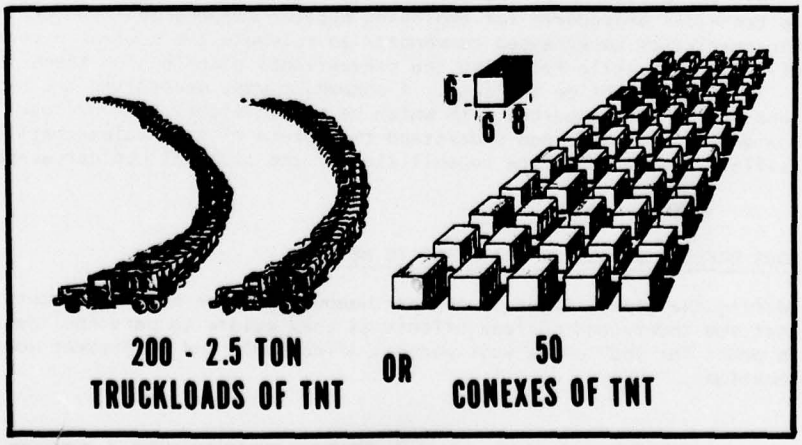


FIGURE 2.TNT EQUIVALENT OF A 1 KT NUCLEAR WEAPON.

The air blast from these bursts will overturn and crush equipment, rupture lungs, and hurl and tumble personnel. Thermal radiation will set fires to combustible materials and cause personnel casualties, especially those with exposed skin. Nuclear radiation will affect critical biological systems and is the dominant casualty producing effect for low tactical yields. The radiation dose at a distance curve for a typical 1 KT fission weapon is shown in Figure 3.

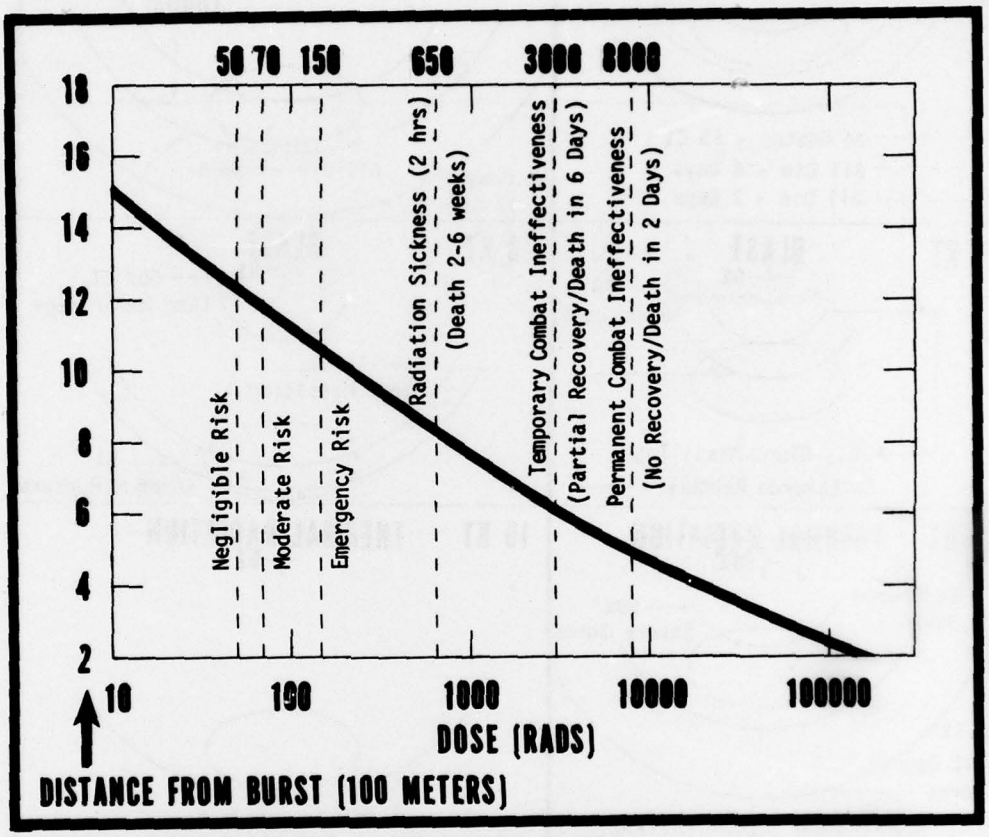
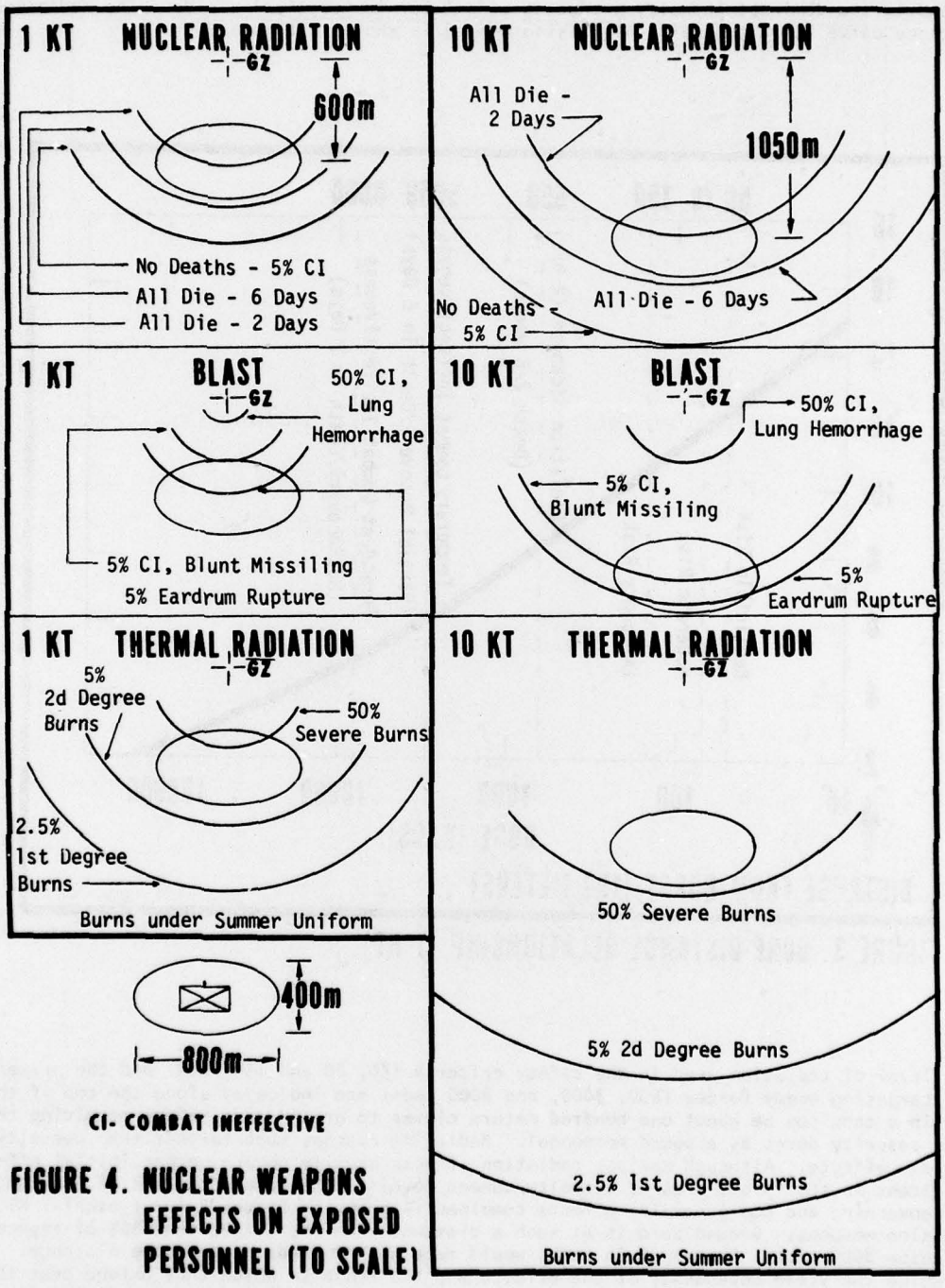


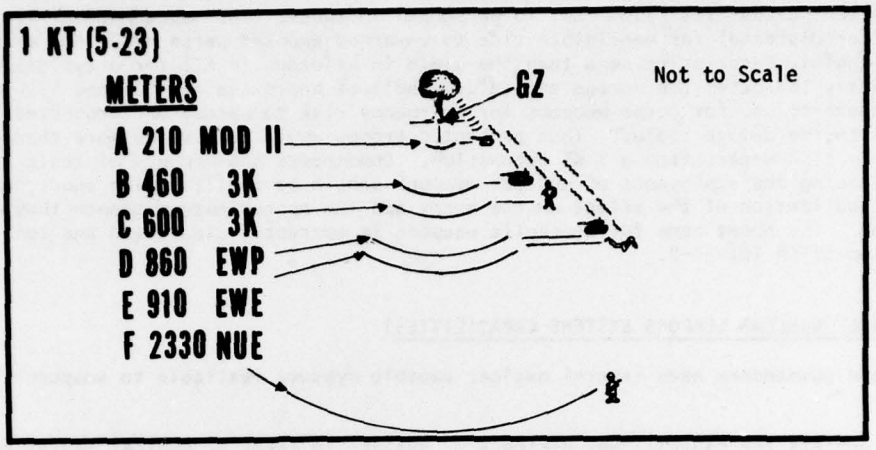
FIGURE 3. DOSE-DISTANCE RELATIONSHIP (1 KT).

The level of radiation used in the safety criteria (50, 70 and 150 rads) and the primary levels used for targeting enemy forces (650, 3000, and 8000 rads) are indicated along the top of the chart. A person in a tank can be about one hundred meters closer to ground zero before receiving the same radiation casualty doses as exposed personnel. Radiation reaches much farther than casualty producing blast effects. Although nuclear radiation effects usually govern, other initial effects may be significant in the target area at casualty/damage levels. The total coverage of a target by both the governing and non-governing effects combined is shown in Figure 4 for typical 1 KT and 10 KT fission weapons. Ground zero is at such a distance from the target that 30% of exposed soldiers receive 8000 rads. Personnel in tanks would receive 3000 rads at the same distance. One should notice the yield dependency of the effects and the range to which they extend over the entire target. Blast and thermal effects are for exposed personnel. At such effects levels personnel in tanks would not be affected. Figure 5 shows the range difference due to degree of protection at casualty levels and safety levels. The risk radii in Figure 5 are negligible to warned protected troops (NWP), emergency to warned exposed (EWE) and negligible to unwarned exposed (NUE).



CI- COMBAT INEFFECTIVE

FIGURE 4. NUCLEAR WEAPONS EFFECTS ON EXPOSED PERSONNEL (TO SCALE)



A. MOD. DAMAGE TO TANKS

B. RAD., PERS. IN TANKS (CAS., 3K)

C. RAD., PERS. IN OPEN (CAS.,3K)

D. RAD., PERS. IN TANKS (SAFETY, EWP)

E. 2° THERMAL (SAFETY, EWE)

F. PERS IN OPEN (SAFETY,NUE)

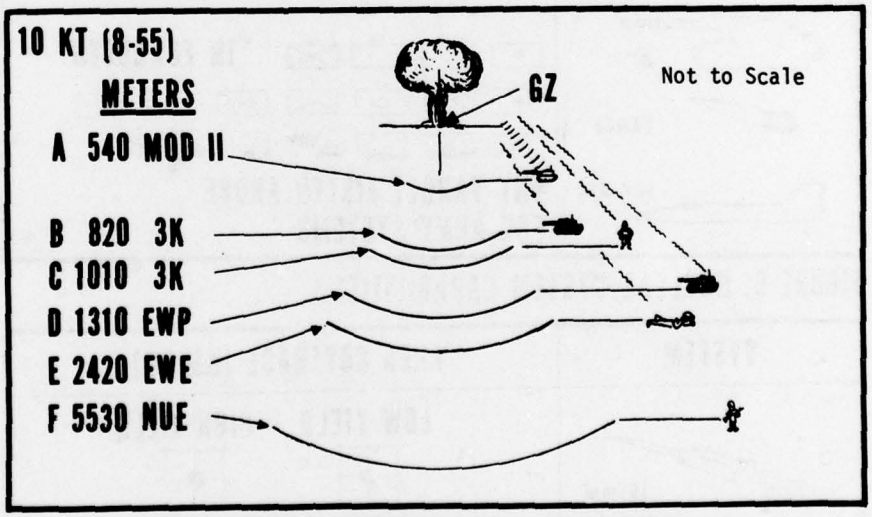


FIGURE 5. TYPICAL RADII OF EFFECTS.

A method of getting a feel for the capabilities of the tactical nuclear weapon systems is to use the so-called "short name" in lieu of calling the system by name and yield. The short name consists of two effects radii rounded to the nearest hundred meters and separated by a dash. The short name is in brackets by the KT designator in Figure 5. The first number is the radius of damage for immediate transient casualties (3000 rad) to personnel in tanks. The second number is the radius of safety (no buffer distance) for negligible risk to unwarned exposed personnel. For example, "5-23" is a more meaningful, descriptive name than the yield in kilotons (1 KT) for a typical weapon, because it clearly indicates the damage and safety radii of approximately 500 and 2300 meters. A good rule of thumb to use for Corps weapons for emergency risk to warned and protected troops is to add 500 meters to the damage radius. Thus protected troops would receive no more than emergency risk at approximately 1100 meters from a 1 KT detonation. Commanders and members of their staffs who are involved in planning the employment of nuclear weapons should be familiar with short names to facilitate their visualization of the effect on the enemy and the approximate distance they must be used beyond the FEBA. The short name for stockpile weapons is currently classified and can be found in the 1977 version of FM 101-31-2.

WHAT ARE FRIENDLY NUCLEAR WEAPONS SYSTEMS CAPABILITIES?

Battlefield commanders have several nuclear capable systems available to support their tactical operations.

Figure 6 depicts the capabilities of the Army systems in terms of typical Soviet targets they can defeat based on their doctrine and Figure 7 indicates the lethal area on the ground. While nuclear weapons are not all-powerful, they enhance the commander's ability to dramatically alter the tactical situation if enough weapons are effectively employed.

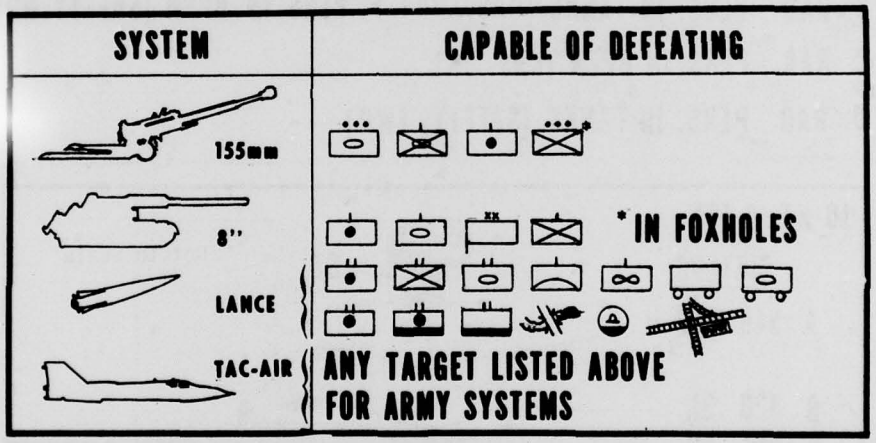


FIGURE 6. NUCLEAR SYSTEM CAPABILITIES.

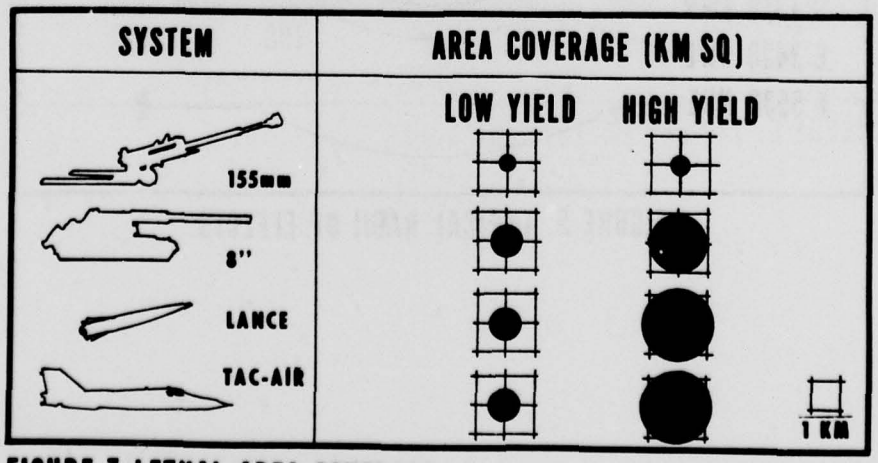


FIGURE 7.LETHAL AREA COVERAGE.

DO I STILL NEED TO WORRY ABOUT TARGET ACQUISITION?

A myth associated with nuclear weapons is that the weapons are so powerful that good target identification and location information is not necessary. On the contrary, target acquisition is just as necessary in nuclear fireplanning and execution as in conventional fireplanning. The more targets that can be acquired with a degree of certainty, the better the picture that can be painted of the true threat facing the Corps. This in turn provides the intelligence necessary to refine weapons employment plans; it provides a nucleus of targets that can be definitely defeated; and it adds to the confidence of defeating a sizeable portion of the attacking force with the fewest number of weapons possible.

CAN YOU SHOW ME HOW TACTICAL NUCLEAR WEAPONS MAY BE EMPLOYED?

An example of the employment areas for tactical nuclear systems is shown in Figure 8. For the purpose of this discussion, let us assume that the interest lies in the plans of a Corps with a sector width of 100 KM. The battlefield support systems, i.e., the cannon systems, are of use for about 10 KM beyond the FEBA due to their doctrinal positioning of 1/2 - 1/3 range. The interdiction systems, i.e., Lance and tactical air, are of utility to a depth of about 150 KM, i.e., to the depth of the enemy forces that can directly influence the tactical situation. Purely in terms of areas, 1000 KM^2 (10 x 100) and 15,000 KM^2 (150 x 100), respectively, it is evident that the entire area could not be covered even if we desired to do so due to the limited lethal area of our stockpile weapons and the number of available weapons. Yet in terms of nuclear weapons capabilities versus conventional firepower, Figure 9 shows that nuclear weapons add a significant amount of firepower to defeat the threat. The new employment concept maximizes effects against the threat within constraints. Specific information required to reduce this total area to something manageable includes

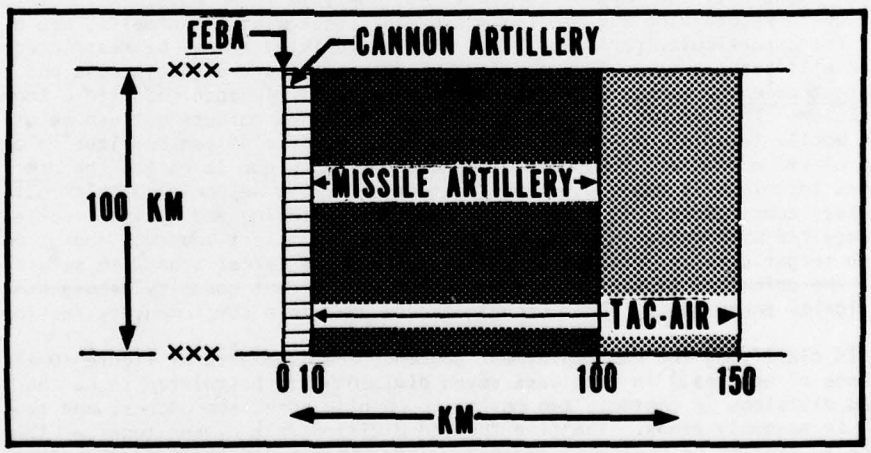


FIGURE 8. TYPICAL EMPLOYMENT AREAS.

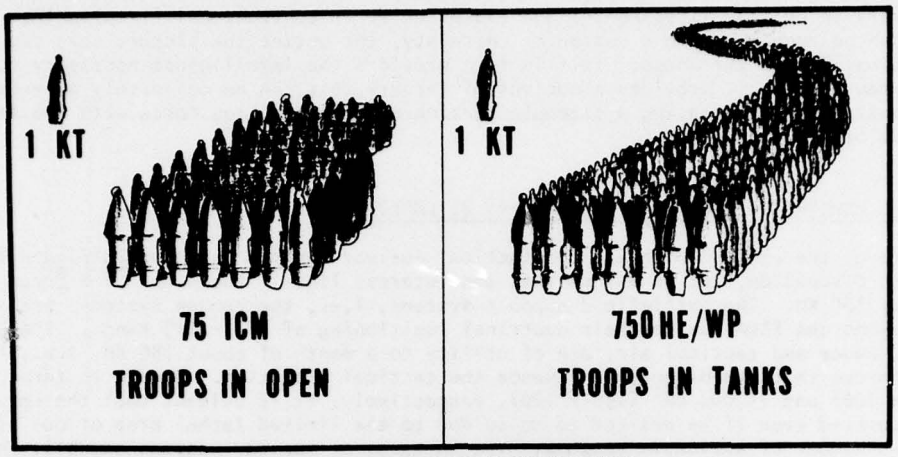


FIGURE 9. NUCLEAR VS. CONVENTIONAL WEAPONS.

the cities to avoid, trafficable terrain, barrier plans, analysis of avenues of approach, and the target acquisition/intelligence picture.

The new employment doctrine emphasizes two target analysis techniques. Both of these techniques are used while recognizing and meeting employment constraints. Normally, use of nuclear weapons will be for a particular period of time, within specified areas, be restricted with yield limitations, and will attempt to achieve a balance between military effectiveness and collateral damage. The target oriented method requires a target to be firmly acquired with a known location, size and composition. This technique lends itself well to fixed targets but can be used against well identified mobile targets. Using this technique, weapon yields can be sized to achieve specific target coverage within employment constraints. The other technique is called the preclusion oriented method since this technique is based on using the most effective weapon(s) within collateral damage and/or troop safety constraints. It is well suited for preplanning and against mobile targets that have not been acquired with certainty. Usually a preliminary target coverage cannot be predicted. In areas of high target density, maximizing effects within the target area with several weapons will not only defeat the principal target, but also realize significant casualty/damage bonus effects to other nearby priority enemy units. Both techniques are used in a complementary fashion.

To assist in clarifying the new employment concept, the schematic of Figure 10 illustrates a simplified package of weapons. In this case seven divisions are postulated to be the threat facing the Corps; three divisions in contact, two moving up on high speed approaches, and two other divisions still in assembly areas. The five forward divisions are closer together than normal because they are in contact or moving to exploit. This increased density invites application of preclusion oriented targeting techniques wherein nuclear weapons effects are maximized in the target area while precluding specified damage levels to cities. The key concepts are that each target does not require a weapon because of the increased unit density and that employment constraints are met while achieving the prescribed military effectiveness. The schematic shows concentrations of 16 nuclear weapons on the northern division, 31 nuclear weapons on the penetrating division, a total of 17 on the southern division, two groupings totaling 19 on the northern exploiting division and 19 nuclear weapons in 3 groups on the southern exploiting division. The +'s represent individual weapons delivered at single targets wherein the unit density does not suggest more than one target or the targets are fixed, i.e. airfields, bridges, logistic facilities, etc. In this package, weapons effects against the target are maximized recognizing and meeting all constraints. The total schedule of fires represents a package of 136 nuclear weapons delivered within one Corps area for a specific tactical contingency. This package illustrates the targets of Corps interest as well as theater interdiction targets in the Corps zone. These weapons would all be delivered within one or two hours.

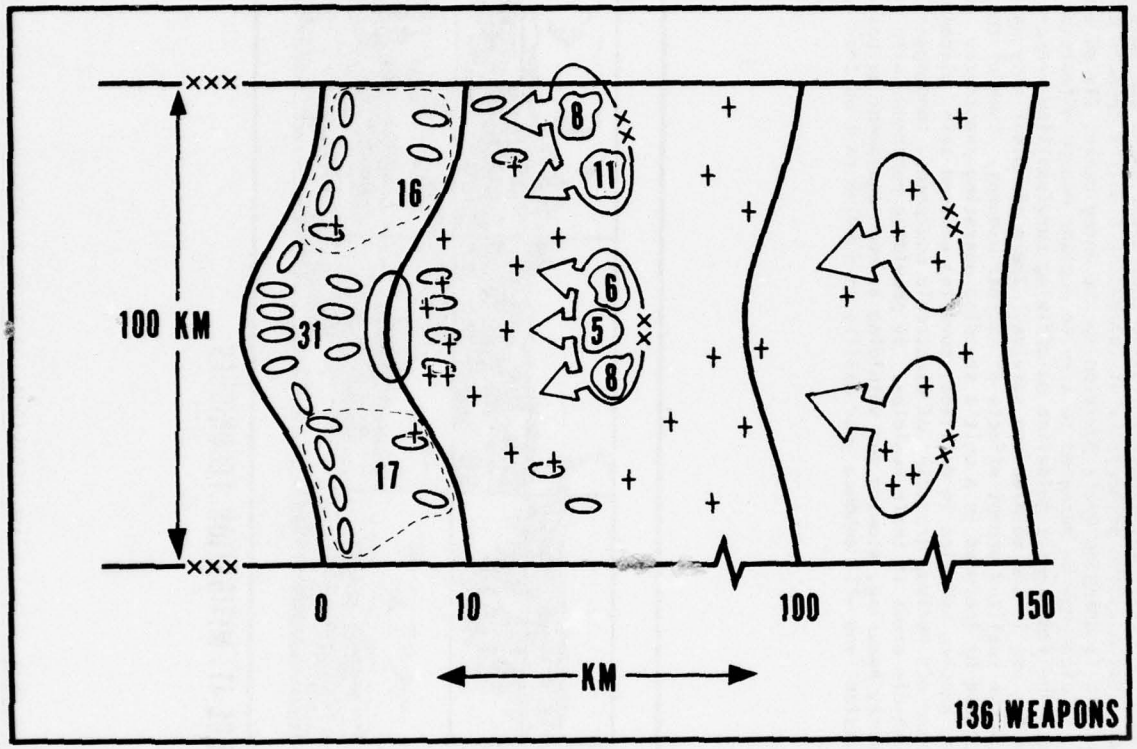


FIGURE 10. TYPICAL CORPS WEAPONS PACKAGE WITH THEATER INTERDICTION TARGETS.

WHAT ABOUT ENEMY NUCLEAR WEAPON CAPABILITIES AND WHAT CAN I DO ABOUT THEM?

Even though Figures 5, 6 and 7 apply similarly to enemy nuclear weapons, one should be aware that the yields of their warheads are typically larger than ours. This could be attributed to less concern for restraint or lack of concern for undesired effects on noncombatants, and it could also be an indication that enemy weapon systems are less accurate than our delivery means.

The emphasis on enemy capabilities is more logically directed toward what commanders can do to decrease personnel and equipment vulnerability so that their units can survive to fight. It is well known that dispersion is the primary way of increasing a unit's chances of surviving a nuclear burst. Another method is changing one's position so the enemy cannot fix an aiming point. The equipment used by soldiers may be hardened to survive nuclear weapon effects or it is sometimes inherently hardened. The fundamental guideline on affixing survivability measures to equipment is to have it available for use if the soldier can survive. There are other easy ways that an individual soldier can reduce the realized prompt effects of nuclear weapons. Some of these methods are shown in Figure 11 and could be included in a unit's standing operating procedure: earth cover over foxholes and bunkers, keeping vehicles in defilade, covering exposed skin, disconnecting a portion of antennas from turned off radios, grounding of electronic equipment, sandbagging vehicles, and keeping armored vehicle crews in their vehicles. By providing personnel with as much cover as possible and by properly securing, stowing and shielding as much equipment as possible without seriously degrading your mission, you will enhance your ability to survive on a nuclear battlefield.

FIGURE 11. MITIGATION TECHNIQUES.

WHAT CAN BE DONE IN UNIT TRAINING AND INDIVIDUAL TRAINING TO PREPARE TO FIGHT IN A NUCLEAR ENVIRONMENT?

As commonplace as it may sound, the best way to prepare to fight on a nuclear battlefield is to perform the basics in a more professional manner. To get the job done on the nuclear battlefield, the same functions performed on the conventional battlefield have to be accomplished on the nuclear battlefield, but faster and better. However, there are three areas where emphasis can be placed during training: communication, dispersion, and decentralized control. In nuclear warfare, communications may be more critical to combat operations than any other factor, so plans for alternate

means must be exercised. Because equipment will be at a premium causing more traffic for fewer facilities, aggressive steps must be taken to have strict communications discipline, eliminating all but combat essential transmissions at all levels. Dispersion on the nuclear battlefield will be paramount for survival. A commander has to control the unit and be able to fight his unit to its highest potential. This potential can only be achieved by the professionally trained unit that has confidence in their neighbor units and fellow soldiers. On the nuclear battlefield more than on the conventional, the need for good prior planning to enable decentralized execution is imperative. The dispersion inherent to the nuclear battlefield coupled with the probable loss of key commanders and degradation of communications makes it essential that our commanders and leaders act on their own initiative in an aggressive manner. To establish control on the nuclear battlefield, strong aggressive leadership without communication or guidance from immediate superiors will be necessary to achieve victory and restore peace.

WHAT SHOULD I REMEMBER ABOUT THIS NUCLEAR NOTE?

Considering the threat which now faces us, commanders and staffs should be prepared to fight on a nuclear/chemical/conventional battlefield. Nuclear weapons capabilities are not difficult to understand and one does not have to be prefix 5 qualified to employ them effectively on the battlefield. Commanders should integrate nuclear weapons into the overall concept of the operation while being ready to aggressively execute the plans with fire and maneuver. It is equally important that commanders train their men to fight and survive on the nuclear battlefield by stressing the enemy's capabilities. With the continued buildup of Warsaw Pact conventional and tactical nuclear forces and their emphasis on developing materiel to fight in the NBC environment, we cannot afford to continue relegating to a low priority the training of troops and development of materiel to fight in a tactical nuclear war.